Electric field

$E=F_e/q$ definition

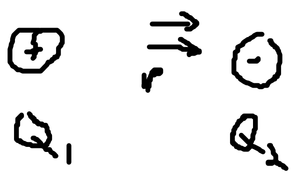
around point charges, Q
$E=KQ/r^2$
if there are multiple charges, you vector sum all the electric fields
E= vector sum of $E_1 + E_2$ ...

The electric field at a point, r from Q.

In a uniform field, don't use that equation, the field is created by charge on parallel plates. Just use $E=F_e/q$ or $E=V/d$ V is voltage between the plates and d is the distance between the plates (derived next class)

Field lines rules:

line represents the direction of force on a small positive test charge, q.

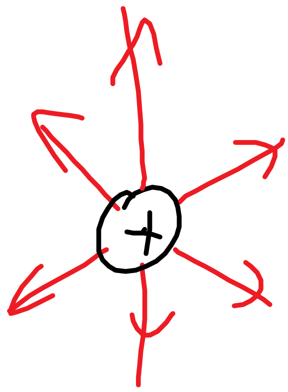


E at point p shows the direction of force if there

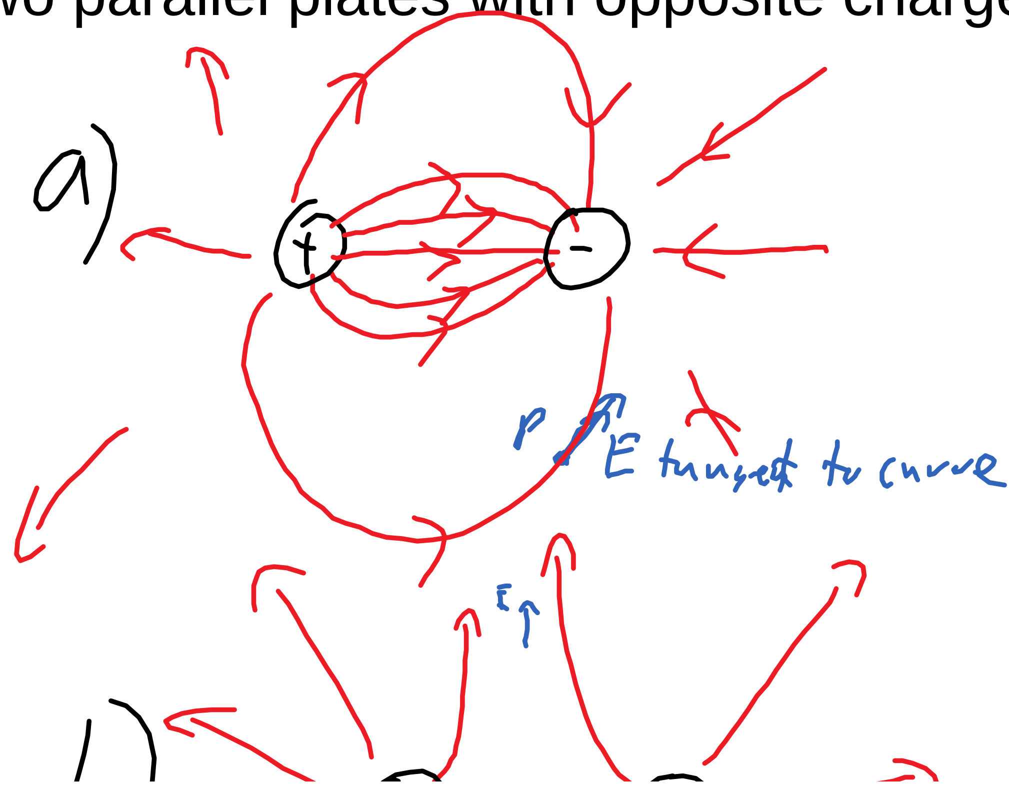
was a positive charge, q at that point.

E lines go from positive to the negative
the density of lines corresponds to the strength of the field
Lines never cross
always perpendicular to conducting surfaces and equipotential lines (next class)
lines are uniform distribution and parallel between infinite charged parallel plates

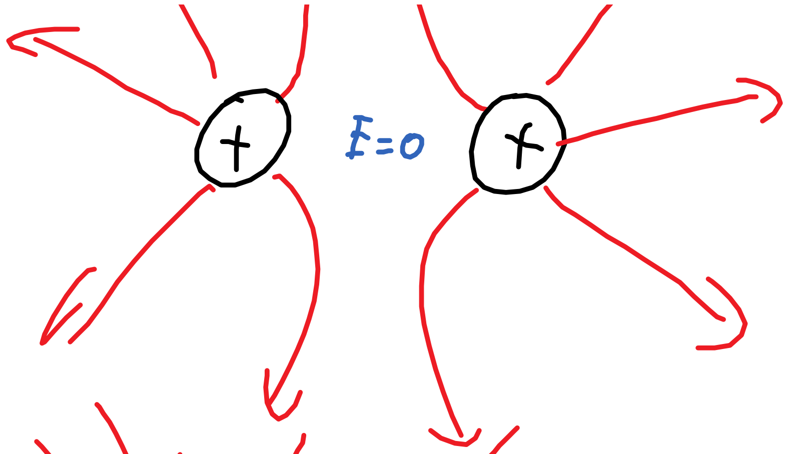
eg. draw the field lines around
a) dipole
b) two equal positive charges
c) $Q_1 = -3.0C$ and $Q_2 = -1.0C$ 4.0 cm apart
calculate the E field at the midpoint between them, and 2.0 cm above the midpoint



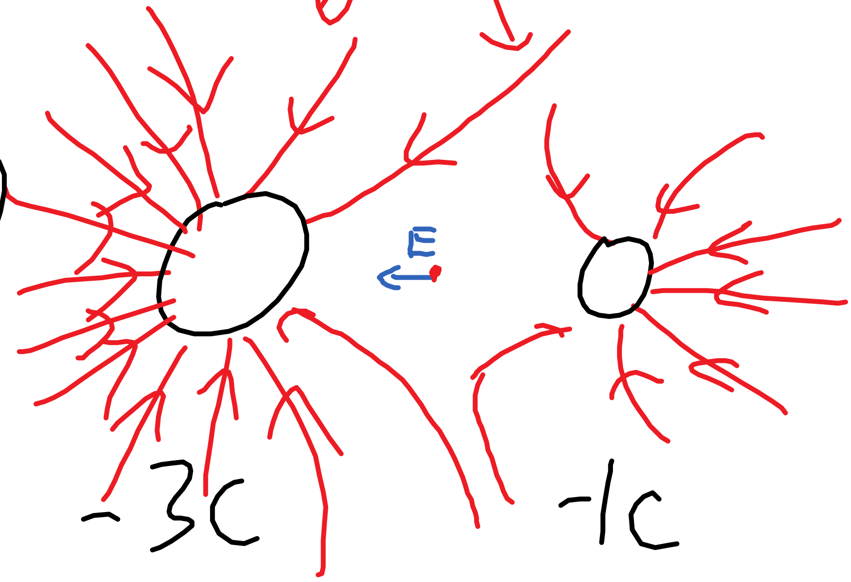
d) two parallel plates with opposite charges



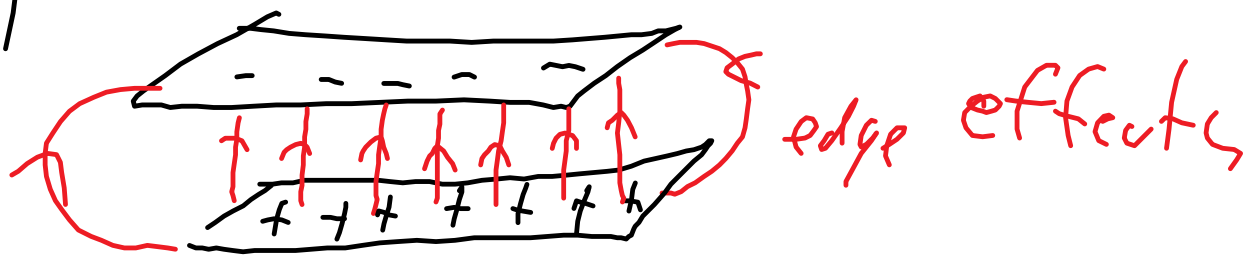
b)



c)



d)



f) calculations $E_1 = \frac{KQ_1}{r_1^2}$

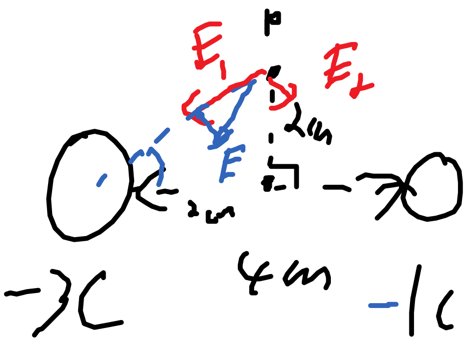
E_1 = 8.99E9x3/(0.02^2)=6.7425E13 N/C
usually measure static charge in micro coulombs

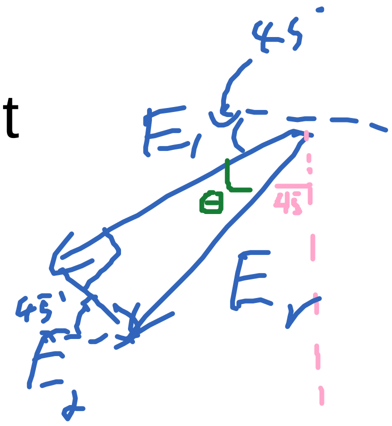
E_2 = 8.99E9x1/(0.02^2)=2.2475E13 N/C

E resultant = E_1 - E_2 (opposite direction)
6.7425E13-2.2475E13=4.495E13

4.5×10^{13}N/C towards Q_1

at point p 2cm above the midpoint





E_1 = 8.99E9x3/(0.02^2+0.02^2)=3.3712E13
3.3712E13 N/C

E_2 = 8.99E9x1/(0.02^2+0.02^2)=1.1237E13

E_r = Sqrt(3.3712E13^2+1.1237E13^2)=
3.55354627520172E13

3.55×10^{13}N/C
θ = Atan(1.1237E13/3.3712E13)=
18.43443895151597 18.43443895151597+45
=63.43443895151598
So the electric field 2 cm above the midpoint would be 3.55×10^{13}N/C 63° below the horizontal towards the -3C charge

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p438
Q15-25, 32, 39, 40